

Generation of Emissions Data for Use in WRF-Chem

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Default Chemical BCs

- `have_bcs_chem = .false.`
- Uses idealized chemical profile generated from the NALROM simulation (see WRF-Chem User's Guide & code for more details)
 - North America summer
 - Limited number of chemical species
 - Originally developed for lower troposphere ozone forecast

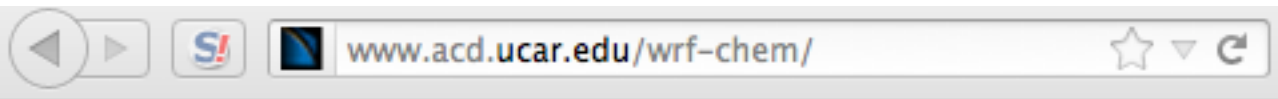
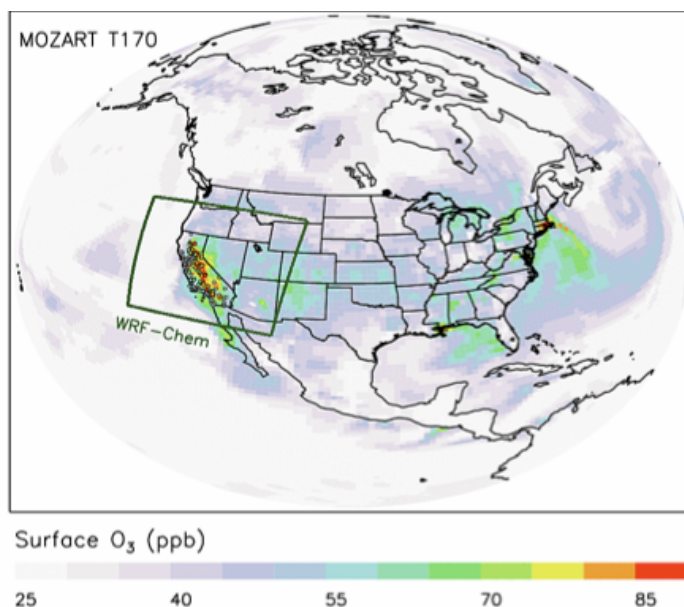
Boundary Conditions

- What does WRF use for lateral boundary conditions?
- Does one need to have chemical boundary conditions?
 - How long until lateral boundary data impacts the center of your 1000 km simulation domain?
 - Advection if $U \sim O[10\text{m/s}]$, $L \sim 36\text{km/h}$;

Chemical Boundary Conditions

mozbc – set chemical initial and lateral boundary conditions

- chemical initial and boundary conditions are needed to account for initial concentrations and inflow/background concentrations



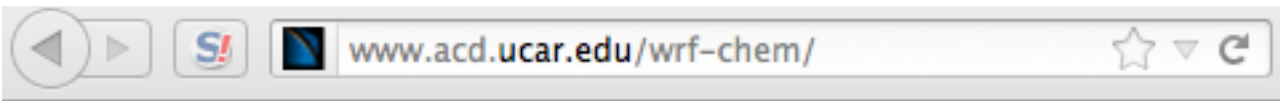
mozbc

NCAR/ACD has developed a program to create time-varying chemical boundary conditions for WRF-Chem from MOZART-4 output. For questions about running mozbc please contact: Stacy Walters (stacy at ucar . edu), Mary Barth (barthm at ucar . edu), or Gabriele Pfister (pfister at ucar . edu). To obtain mozbc, see the **Download** section below.

Chemical Boundary Conditions

mozbc – set chemical initial and lateral boundary conditions

- fills the chemical fields in *wrfinput_d<domain>* and *wrfbdy_d<domain>* with global model output (run after real.exe and before wrf.exe)
- set-up for MOZART-4 and CAM-Chem global model output
- controlled by namelist file (e.g. define species mapping; mappings available for MOZART to RACM, RADM, CBMZ, MADE/Sorgam, MOZAIC, GOCART)
- Interpolation in time and space
- global MOZART-4 output for past years and forecasts available on Web (<http://web3.acd.ucar.edu/wrf-chem/mozart.shtml>)



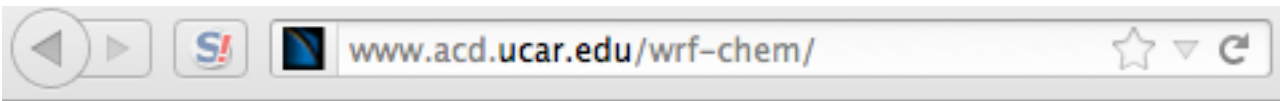
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Chemical Boundary Conditions

mozbc – set chemical initial and lateral boundary conditions

- *mozbc* operates on the most common map projections in WRF (Lambert, Mercator, Polar, Lat/Lon)
- To compile: *make_mozbc* -> will create the executable *mozbc*
- Package includes example namelist files (“mozbc.inp”)
- To run: *mozbc < mozbc.inp > mozbc.out*
- to enable chemical IC and BC when running WRF-Chem
set in namelist.input: `have_bcs_chem = .true`



mozbc

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Chemical Boundary Conditions

Example namelist file for mozbc:

&control

do_bc = .true.

defines if BC are set (default: .false.)

do_ic = .true.

defines if IC are set (default: .false.)

domain = 2

number of domains to work on (default: 1);

e.g. d=2 sets BC for d01 and IC for d01 and d02

dir_wrf = '/ptmp/me/WRF_chem/'

path to WRF-Chem files (met_em, wrfinp*, wrfbdy*)*

dir_moz = '/ptmp/me/MOZBC/'

path to MOZART/CAM-Chem input files

fn_moz = 'h0001.nc'

initial MOZART/CAM-Chem file; mozbc increments filenames,

filenames must be of the form

prefix<nnn>.nc

moz_var_suffix = '_VMR_avrg'

suffix string for MOZART/CAM-Chem variables (default: '_VMR_inst')

met_file_prefix = 'met_em'

prefix string for the WRF meteorological files (default: 'met_em')

{standard WRF names:

met_em.d<nn>.<yyyy-mm-dd_hh:mm:ss>.nc }

met_file_suffix = '.nc'

suffix string for the WRF meteorological files (default: '.nc')

met_file_separator = '.'

separator character for WRF meteorological files (default: '.')

spc_map = 'o3 -> O3', 'o -> O', 'o1d_cb4 -> O1D', 'n2o -> N2O', 'no -> NO',

...

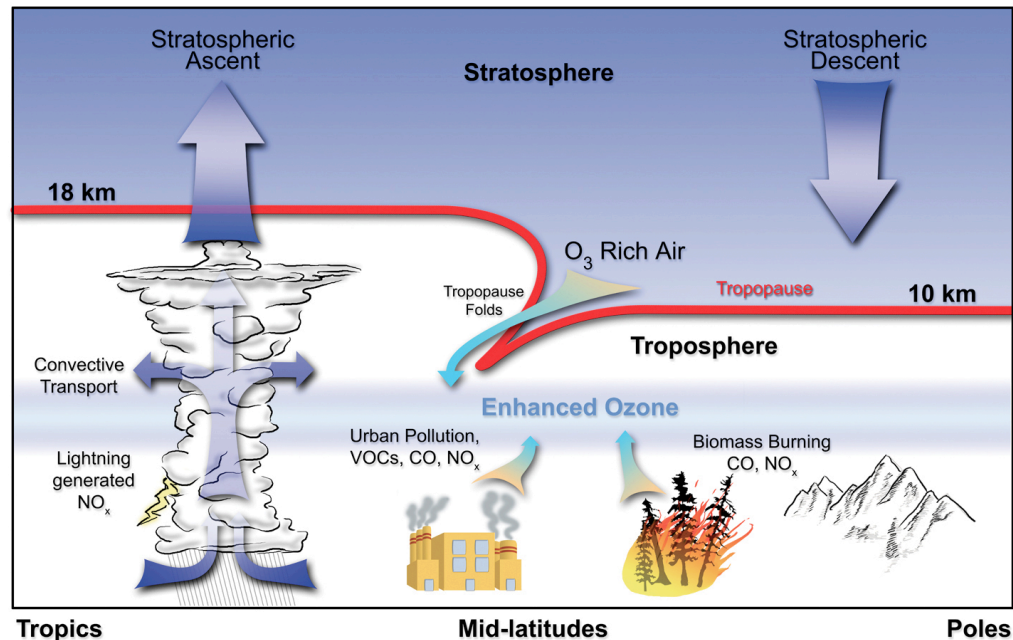
'DUST_4 -> .2348*[DUST3]+.5869*[DUST4];1.e9', 'DUST_5 -> .5869*[DUST4];1.e9'

/

Chemical Boundary Conditions

ubc - upper chemical boundary conditions

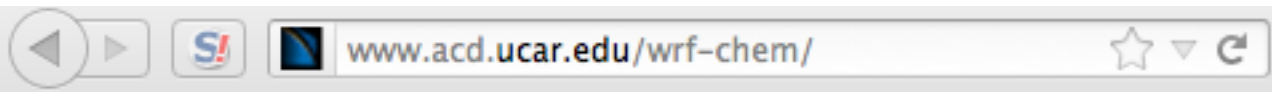
- WRF-Chem does not have a stratosphere – possible issues when looking at UTLS, STE influence or comparing to satellite products (e.g. trop. O_3 re...)



Chemical Boundary Conditions

ubc - upper chemical boundary conditions

- *o3, no, no2, hno3, ch4, co, n2o, n2o5* are set to climatology above certain pressure level and relaxed to tropopause level below (pressure level can be set by user)
- Same scheme as used in MOZART-4 and CAM-Chem
- Climatologies for present and future available on Website
- namelist.input (&chem):
 have_bcs_upper = .true.
 fixed_upper_bc = 50.
 fixed_ubc_inname = "ubvals_b40.20th.track1_1996-2005.nc"



Upper Boundary Conditions

Download input files for running WRF-Chem V3.3.1 with Chemical Upper Boundary Conditions: [UBC_inputs.tar](#)